The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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No. 1202

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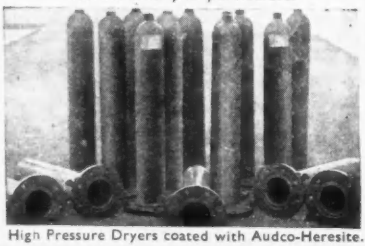

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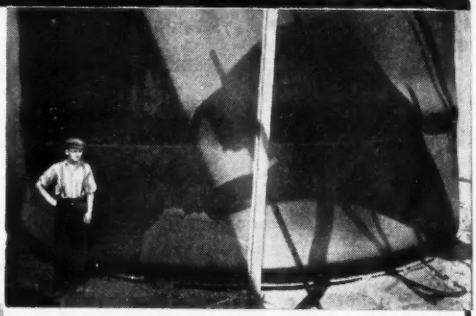

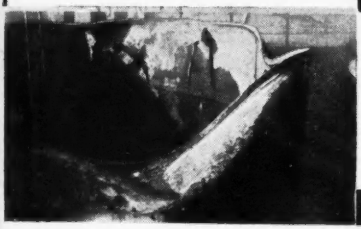

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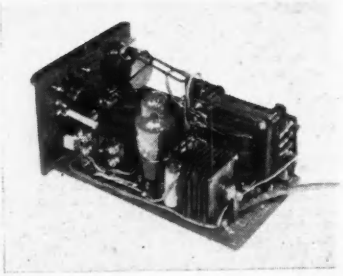

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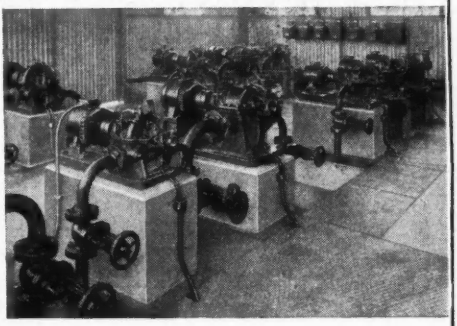

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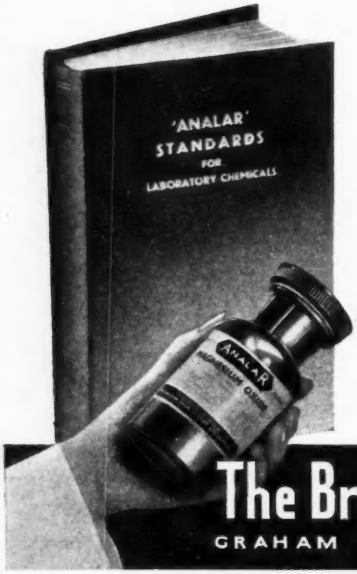

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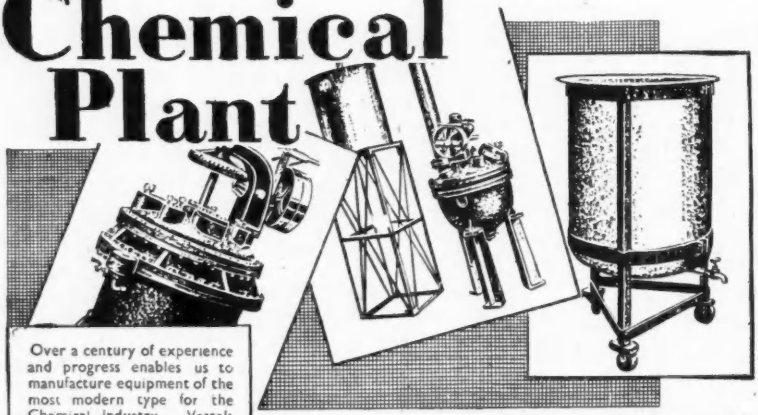

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The Rise of the Soya Industry

FOR over 8000 years a plant of the order *Leguminosæ* has been one of the principal crops of China. Yet it is only in the last twenty years that this Cinderella has been considered worthy of note in the Western world. The story of the soya bean (*Glycine soja*) may well form an important chapter in the history of chemical industry, since its rapid rise to a position of major importance is due primarily to industrial chemical research. Although it was widely used as an important part of Chinese diet, the early travellers who introduced tea and silk to Europe failed to exploit the soya bean. The only other race to adopt its cultivation to any extent prior to the present century was the Japanese. In spite of this, Manchuria's recent annual *export* of the soya bean and its products reached a value of £4,000,000; and this takes no account of the large crops grown in the U.S.A., Bessarabia, and many other regions.

To some extent the war of 1914-1918 was responsible for this development. Scientists in the United States, threatened by a shortage of cotton-seed, realised that the little beans from the soya plant offered a sound alternative source of the cake and oil which provided feeding stuffs for cattle and edible oils to be used in the manufacture of margarine and other similar products. The extensive research begun in the war years continued after the urgent necessity for it died. Consequently, the soya-bean crops in the United States increased rapidly, to an acreage of five and a half million in 1935, compared with the 1907 figure of 50,000 acres. In *China To-day*, a booklet published to commemorate the thirtieth anniversary of the Chinese Republic, S. Yap reviews some of the numerous uses which scientific investigation has discovered for this amazing plant, uses which are much enhanced in value by the advent of the present war.

The soya-bean pod contains from two to five small beans, which form the important part of the plant's produce. These beans may be dried and ground to give a meal, or they may first be pressed to separate the oil, the residue being once more ground to a meal. The product from the dried beans, as the analyses quoted show, may contain as high as 50 per cent. protein, 24 per cent. fats, and about 20 per cent. carbohydrates. Naturally the meal, which rarely falls below 30 per cent. protein content, is an excellent basis for

On Other Pages

Notes and Comments 22
Big Milk-Testing Scheme ... 24
Recent Developments in Analytical Chemistry, I 25
A Chemist's Bookshelf 28
Gas Producers, II 29
Chemical Compounds for Insecticides 31
Synthetics in the Varnish Industry 33
Chemists and Coupons 35
The French Chemical Industry ... 36
Catalytic Activity 37
Personal Notes 38
General News from Week to Week 39
New Control Orders 41
British Chemical Prices 41
Stocks and Shares 42
Commercial Intelligence 42

feeding stuffs for all types of animal; and it may also be used (usually in admixture) for human consumption. In addition, a milk can be prepared from the meal, the composition of which corresponds quite closely (except in milk-sugar content) with cow's milk, and which may be curdled in the normal fashion to give a cheese.

Although as an unrivalled source of protein the soya bean is naturally of first importance in war time, this is by no means its most notable claim to recognition. There is infinite promise of its development in the plastics industries; from it an easily moulded plastic, capable of taking a very high polish, can be prepared. This line has been exploited to a considerable extent by Henry Ford, who apparently proposes to use soya plastic extensively in his projected plastic-bodied automobile, and for this purpose maintains a considerable acreage of the crop. Synthetic fibres similar to wool and silk may also be derived from the meal, and it is reported that Japan is in process of initiating industrial production of artificial silk from this source.

The oil pressed from soya beans provides constituents for margarine and other edible oils, as well as affording a primary material for soap, lubricating oils, and many other products of allied classes. A fuel similar to petroleum may be derived from the oil, and is suitable either as a motor-fuel or for illuminating purposes. The interest shown by Germany in soya-bean culture may be stressed. In his article, Mr. Yap quotes the *New York Times* to the effect that much of the oil from the soya-bean crops available to Germany was being used by that country in explosives manufacture. The prime importance to Japan of Manchuria, with its enormous soya-bean resources, is also a major factor in the war.

Undoubtedly, however, the plant in both its humane and its warlike derivation is not neglected by the Allied Nations. American and Russian interest in the soya bean was wide awake long before the outbreak of the present struggle. This humble legume, once serving only to feed the peasant of China and to flavour the dishes of Japan, may yet, with the industrial chemist as cook, yield a somewhat more pungent sauce for Japan and her co-partners in destruction.

NOTES AND COMMENTS

News from the S.C.I. Report

IN preparation for its 61st annual meeting, held on Friday this week, the Society of Chemical Industry has published its Council's annual report, to which is appended a programme of the meeting, some details of which will be published in next week's issue of THE CHEMICAL AGE. The report appears in the slightly abbreviated form made customary during war-time, and contains one or two points of special interest. Membership of the Society has risen, since the end of 1940, from 3950 to 4736, an encouraging indication of the healthy state of the industry, especially when it is remembered that the last 12 months have contributed an exceptionally heavy obituary list. A great number of distinguished chemists have died during the period under review, and the Society has suffered many grievous losses, the majority of which have been recorded in our columns. The ceremony of conferring honorary membership on distinguished chemists is being observed for the first time since the outbreak of war, and two outstanding American chemists, Professor M. T. Bogert and Dr. J. B. Conant, and their no less notable British colleague, Dr. Bernard Dyer, will receive their honour at the annual meeting. Another important piece of news is the forthcoming establishment of the new Agriculture Group, with Sir John Russell (this year's Messel Medallist) as its chairman.

Science Attacks Bureaucracy

CAN it be that a major attack on red tape is about to develop on a new sector of the anti-bureaucratic front? Are the scientists about to break their habitual silence and say what they really feel about the strangling of technical development by administrative officialdom? To judge by the response which Professor A. V. Hill's letter to *The Times*, advocating a central control for the scientific development of production, has aroused, something of the kind would seem to be likely. Quite a considerable volume of correspondence supporting Professor Hill's project has made itself manifest since the publication of his momentous letter; the individual correspondents of last week have this week been succeeded by the representatives of scientific societies. Dr. Cullen, writing from the Society of Chemical Industry, and Mrs. Fremlin, from the Association of Scientific Workers, have both lent their support to the campaign, and both seem satisfied that their contentions are

supported by a very large body of scientific opinion throughout the country. Dr. Cullen makes the very interesting point that scientific and technical control is regarded in Government departments as a rather low-class affair, and is kept entirely subordinate to administration. A very different state of affairs prevails in scientific associations. Mrs. Fremlin speaks, with knowledge, of the inefficiency prevalent in the official utilisation of technical developments, and of the difficulties of pooling technical information. We heartily endorse her conclusion that Professor Hill's suggestions will be welcomed by the whole scientific profession.

Returning Machinery

MANY firms whose machinery has been requisitioned by the Government and removed to other premises, for the wholly admirable purpose of increasing its efficiency in the production of war materials, will be watching with interest for the elucidation of a point which has been raised in Parliament by Sir Granville Gibson, M.P. Sir Granville asked about the cost of re-installating of plant in its original premises after the war. Apparently, the Government is not prepared to do more than pay for the initial removal and installation in the new factory, the return of the machinery being left as a problem for solution later. Sir Granville, at a recent meeting of the Leeds Chamber of Commerce, referred to the Chancellor of the Exchequer's reply as unsatisfactory. We may soon expect him to ask further questions with a view to relieving the anxiety of firms all over the country to whom this is an extremely important matter. If machinery is "called up" in time of war no complaint should be heard from its owner, but at least he is entitled to know that when, in the course of time, it "gets its discharge," its return shall not be delayed by misunderstandings as to who is responsible for it.

Psychology of Hoarding

WHAT is it in us mortals that makes us value most those things which other people want, irrespective of whether we are making any use of them or not? This question of hoarding is getting beyond the mere economist into the more nebulous realm of the psychologist. From the woman who tacks herself on blindly to the end of a queue to the works manager who hides his little pieces of long-neglected scrap as soon as he hears someone ask for it on the wireless, we are all in some measure guilty of impeding the war effort. In America the same reluctance to turn out scrap essential for the fulfilment of President Roosevelt's huge armament programme is being experienced. Last month a collection of scrap rubber was organised in the United States. After about two weeks only 219,000 tons had been produced by a population of over 131,000,000 people. Why, if every household had thrown out merely an old bath mat and a worn hot water bottle they should have got more than that, let alone the large quantities of scrap which must be lying in workshops and factories throughout the length and breadth of the States. Neither we nor the Americans have yet learnt to be as generous with our hoards of vital materials as we have been with our savings. We all recognise the necessity of giving up the stuff, but when it comes to the actual point, that little imp of possessiveness within us seems so often to get the upper hand. It would be as well to remember at such times that if the war is to be won we must disgorge, and each delay increases the cost to the country of its collection.

Salvage Facts

IF the public is somewhat dilatory in producing its scrap, the authorities in this country at least cannot be entirely absolved from blame. There is no great inspiration in a bleak request for old rubber and books. The public should be told in the most colourful way possible why every atom of material is important. Let us give an illustration. Some time ago an Army unit consisting of several hundreds of men started a salvage campaign. The men were warned on parade against waste, and entreated during lectures to turn in every possible piece of scrap. The result over a number of weeks was poor. Then the C.O. appointed a salvage officer—a young man with ideas of his own. The young officer began by publishing a weekly salvage sheet, written in a bright and breezy style, telling the troops what was happening to their old paper, bones, and metal, and working up a competitive spirit between the component bodies of the unit. He received many hints that he was wasting more paper than he was instrumental in recovering, but he kept on, even increasing his output of brightly-produced propaganda. The result, in a short time, justified his persistence. His name became a joke among the troops—but they scrambled for his salvage news sheet and read every word he stuck on the notice boards; and more important still, the salvage came rolling in in piles. A scrap of information is worth a volume of stern warnings. In this respect an American industrial house journal recently gave some estimates of how salvage aids production. It states, for instance, that 21½ lb. of scrap rubber will make a tyre, while one civilian respirator needs only 1 lb. of scrap rubber; 22½ lb. of scrap rubber are enough for the requirements of a battleship. From two to ten miles of scrap copper are needed to make an Army bomber airborne, and 2,000,000 lb. of waste paper is equivalent to the packing used for the canned tomatoes bought by the U.S. Army in 1941.

Big Milk-Testing Scheme

Broad Plans to Test and Raise Keeping Qualities

IT would be difficult to mention any part of the war effort in which the chemical industry has not taken its place as a major contributor or, in a more modest capacity, as a factor in the increased efficiency of operation. It has long been the practice of our leading milk distributors and manufacturers to carry out chemical tests in order to get the best out of different qualities of milk. Now the Ministry of Agriculture is turning to established laboratories to help in an ambitious scheme which, when fully operative, will provide every county with units in an organisation for testing the keeping qualities of milk as it comes from the farms. The results of these proposed tests will determine what is to be done with the milk. The best will be passed for the liquid market, while a lower category will be marked "Salvage" and treated as unsuitable for the liquid market. Milk that falls below this standard will be marked "Rejected" and returned to the farmer. It is intended that farms whose milk does not pass the highest test will be visited by an adviser so that he and the farmer concerned can discuss methods of improving the keeping quality of the milk.

The Resazurin Test

Since the beginning of the war the Ministry of Food has been carrying out experimental tests in Shropshire, Cornwall, Berkshire, and Carmarthen with three different reagents in order to determine the best method for this purpose. Out of the three tests—which were the ten-minute resazurin, the one-hour resazurin, and the three-hour methylene blue—it is likely that resazurin will be the reagent adopted. In the first of these tests, the solution is added to the milk sample to be tested, which is held at a temperature of 37° C. for ten minutes. It is then placed in a comparator and a disc reading is taken. After making the final decision on this selection of the standard test, the Technical Sub-Committee acting for the Ministry will put the finishing touches to the draft scheme and this, on the approval of the Advisory Committee, will be put into immediate operation. It is stressed that the purpose of the test is not directly concerned with public health or the grading of milk into special designated qualities. It is designed purely to determine the commercial keeping qualities of the milk.

The war has put a great strain on the preservation of milk from tainting and souring owing to special problems of transport and distribution. It has often been found necessary to carry milk to the big consuming centres from producers much further removed from them than was the case in peace-time. It is believed that the new scheme will result in a substantial reduction in wastage through the mixture of unsatisfactory milk with good milk. It is obvious that a scheme of this nature implies a widespread organisation with large numbers of experts, and it is fortunate that our leading firms have worked for many years on the task of keeping up and improving the standard of milk. The Government's intention now seems to be to utilise and develop the existing trade testing organisation. Where laboratories exist at the depots, dairies, and creameries where the milk is assembled from the farms, they will be licensed for the special work required of them. Qualified testers already working in the laboratories will, it is proposed, carry on after being awarded a special certificate. Where necessary, laboratory workers will receive special courses of instruction before being granted this working certificate for testing. This may mean that if a chemist is not considered to have had the necessary experience he may have to spend a few days with the Provincial Dairy Bacteriologist before receiving his certificate.

The Sub-Committee

Chairman of the Technical Sub-Committee is Professor H. D. Kay, who is also vice-chairman of the Ministry's Advisory Committee. Professor Kay is director of the National Institute for Research in Dairying, and is also part-time adviser in dairying to the Ministry of Agriculture. Leading chemists on the staffs of our large milk-distributing firms and manufacturers are members of the Technical Sub-Committee, not, however, representing their firms, but as members of the Central Milk Distributive Council. These include Mr. A. Glover, of the C.W.S. research department, Manchester, Mr. H. C. Hillman, of Cow & Gate, Ltd., Mr. A. L. Barton, of the Express Dairy Co., Ltd., and Mr. E. B. Anderson, of United Dairies, Ltd.

It will naturally take time to establish these centres throughout the country, but the existing laboratories of the more enterprising milk firms will form an important nucleus for the scheme.

Recent Developments in Analytical Chemistry—I

(From our Analytical Correspondent.)

THIS article is the first of a series designed to draw attention to some recently published analytical procedures and devices. In addition to dealing with those methods which have been designed specifically for industrial purposes, it is intended to include notes on some more academic researches which might find useful industrial application.

Alloys

Aluminium.—A rapid method for the determination of aluminium in magnesium alloys[1] makes use of 8-hydroxyquinoline (oxine) to separate the aluminium from other metals in the alloy. A preliminary precipitation of the aluminum as hydroxide is carried out, tests showing that double precipitation is not necessary in routine work, even if appreciable amounts of zinc are present. The precipitate is redissolved, and tartaric acid added. If the solution is now made just alkaline, any large amount of iron present may be removed by H_2S. On bringing the solution back just to the acid side, addition of oxine and ammonium acetate at 70° C. precipitates the aluminium quantitatively. The estimation is now completed by a modified Koppeschaar's method. The oxine precipitate is dissolved in hydrochloric acid, and an excess of standard bromide-bromate solution is added. In the presence of potassium iodide, a back titration with standard thiosulphate gives the amount of excess bromine and, by difference, the aluminium value. If aluminium contains important amounts of heavy metals, it is stated[2] that these may best be removed by electrolysis with a mercury cathode, the aluminium being subsequently determined in the remaining electrolyte by normal precipitation procedure.

Copper.—A rapid method for determining copper in alloys[3] depends on the liberation by the copper of iodine from potassium iodide in a solution containing urea and ammonium acetate. This may be followed by a direct estimation of the liberated iodine, using thiosulphate.

Steel.—The spectrophotometer has been applied to the determination of combined nitrogen in steels.[4] The nitrogen is first liberated in a Pyrex micro-Kjeldahl unit by the usual methods, and the resulting ammonia is distilled over directly into a Nessler tube. The total time required for one distillation is only five minutes, and the next sample may be distilled immediately. To the distillate Nessler's reagent is added, and the transmittance of the solution is then measured in a 300 A.U. band, preferably lying within the range 3900-5000 A.U. It is claimed that this procedure is the equal in accuracy of ordinary macro methods, while it has a considerable advantage in time-saving. It has a wide application, being capable of use with steels containing carbon, chromium, nickel, molybdenum, and aluminium. It cannot, however, be used for pig iron, or for steels which contain much silicon, titanium, vanadium, tungsten, or cobalt.

Silver.—While not specifically carried out with a view to alloy analysis, an investigation into the colorimetric determination of silver[5] may be of interest to chemists who wish to estimate silver in alloys. The reagent investigated, the preparation of which has been described elsewhere,[6] is 2-thio-5-keto-4-carbethoxy-1, 3-dihydropyrimidine. Since only mercurous and mercuric ions interfere seriously (coloured ions interfere if present in such amounts as to make their colour appreciable) the authors claim this reagent to be preferable to *p*-dimethylamino benzal rhodanine, both for the qualitative and the quantitative determination of silver. The estimation is carried out colorimetrically, using the region round 5000 A.U. for intensity measurements.

Spectroscopy

An important part of the theory of the internal standard method of spectrographic quantitative analysis has been fully treated in a recent paper.[7] This concerns the errors that may arise where the estimation depends on the differences in opacity of lines as measured by the microphotometer, and more particularly the errors which arise from the physico-chemical nature of the photographic process. It is usually recommended that the densities of the lines used for reference should both lie on the straight portion of the characteristic curve for the plate employed. In order to help to attain this, the authors recommend the use of contrasty plates and developer, and careful attention to the actual development process itself (time, temperature, etc.) They also show that the closeness of the pairs used for comparison has considerable significance, although lines which are far apart may have a correction applied for the effect of the distance between them, it is preferable to use lines whose separation does not exceed a certain definite value. For the pairs used by the authors in applying this work to duralumin, the maximum allowable distance apart without

such correction is 300 A.U. A justifiable plea is made in the same paper that all published processes using the internal standard method should give, among other data, specimen opacities actually determined, the distance of the electrodes from the spectrograph slit, and a description of the optical system and of the exposure. All these factors are of importance, and if not indicated, other workers may be unable to reproduce the results.

Molybdenum Complexes

A number of recent papers have dealt with the use of molybdenum complexes for the estimation of phosphorus, silicon, and arsenic.

Phosphorus.—Three papers describe the determination of phosphorus by utilising the blue colour developed with molybdate in the presence of reducing agents. Fontaine[8] finds that stannous chloride is satisfactory as a reducing agent, giving a colour which is stable for 24 hours, and is not easily affected by variations in the amounts of reagents. The amounts of phosphorus estimated ranged from 2 to 24 μg. It is stressed that under these conditions the preferable range for intensity measurements is round about 8200 A.U.

Sperry,[9] determining phosphorus in lipid extracts, and Sherman,[10] applying his method to soils, both use 1, 2, 4-aminonaphthol sulphonic acid as reducing agent. Sperry measures the intensity in the region 3500-4300 A.U., and only notes a stability of 30 to 60 minutes for the colour in this region. An accuracy of about $\pm$ 2 per cent. with amounts of the order 2 to 20 μg; is claimed. Sherman's method is directed mainly to the prevention of interference by arsenic; this is achieved through a preliminary reduction of arsenate to arsenite by excess sodium bisulphite. Arsenite does not produce the molybdenum blue colour The author states that stannous chloride proved less satisfactory than the aminonaphthol sulphonic acid for the final reduction. Instead of the blue complex, Koenig and Johnson[11] apply colorimetry to a yellow phospho-vanado-molybdate complex, measuring the transmittance in the range 4300-4700 A.U.

An ingenious determination of the element in lubricating oils[12] depends on the precipitation of the ordinary yellow phosphomolybdate, after ignition to convert the phosphorus to phosphate. Varying the more usual methods for dealing with this complex, the precipitation is carried out in a special graduated centrifuge tube. After centrifuging under standard conditions, the high factor of the complex permits of the calculation of the phosphorus content from the *volume* of the precipitate, with an accuracy precise enough for routine analysis. Yet another variation on normal methods has been evolved for the polarographic estimation of phosphorus in biological materials such as foods.[13] Phosphate ion does not give a polarograph wave at the dropping mercury cathode, but molybdate does. By adding excess of a molybdate solution to the unknown phosphate solution, and determining polarographically the intitial and final concentrations of molybdate ion, the phosphorus can be determined by difference with an accuracy of 1-2 per cent., a considerable saving of time and avoidance of much manipulation

Silicon.—Since silicon reacts somewhat similarly to phosphorus with molybdate, the yellow silicomolybdate has been applied to the colorimetric determination of this element in aluminium and aluminium alloys. Standardised picric acid solutions may be used as comparison standards for the unknowns,[14] or preferably the transmission of the 4358 A.U. mercury line is determined photometrically.[15]

Arsenic.—This element, if phosphorus is present,[16] is first oxidised, so that both elements are converted to the higher anions. Subsequent reduction transforms the arsenate back to the trivalent form, enabling it to be evolved as arsine, and collected in an acid solution containing mercuric chloride and potassium permanganate. This is induced to give the molybdenum blue, using hydrazine sulphate as reducing agent, and the transmittance is measured in the 7000 A.U. region. The accuracy claimed for this method is $\pm$ 5 per cent. for 5-10 μg. and $\pm$ 10 per cent. for 1-2 μg; low figures are obtained in the presence of antimony.

The Gutzeit Test

It has been found[17] that if, in place of the more usual paper strips, impregnated threads in close-fitting glass capillaries are used for the measurement of the arsenic stain, more constant results are obtained for quantities of arsenic of the order of 1 μg. The method is also claimed to be more sensitive. The use of zinc containing 0.3 per cent. of alloyed copper, instead of ordinary granulated zinc, and substitution of mercuric bromide papers for mercuric chloride papers are both advocated in order to improve the accuracy and reliability of the Gutzeit test.[18]

Sulphur.—A review of the methods for estimating sulphur in lubricating oils is followed by a recommended method.[19] The lubricating oil, dissolved in an acetone-benzene mixture, is refluxed with bright copper gauze, when any sulphur present forms copper sulphide. After all the sulphur is thus fixed on the copper, sulphuretted hydrogen is evolved by treatment of the gauze with concentrated hydrochloric acid. The gas is carried over by a stream of nitrogen into a cadmium chloride solu-

tion in a specially designed apparatus which requires no transference of material throughout the complete estimation. Thereafter the procedure follows that proposed earlier for the estimation of sulphuretted hydrogen in gases and solution,[20] the cadmium sulphide formed being estimated iodometrically. It is claimed that as little as 0.001 per cent. of sulphur can be determined in lubricating oils by this method. The estimation of sulphur in coke and coal has been the subject of a series of tests sponsored by the A. S. T. M. Committee.[21] Eight laboratories co-operated, and on the basis of their results the committee has recommended the volumetric estimation of sulphur, either by sodium rhodizonate or by tetrahydroxyquinone as alternatives to the more normal gravimetric method. The volumetric methods are stated to show a saving in time for routine work, and an accuracy equal to that of the gravimetric.

Zinc.—A new indicator has been applied satisfactorily to the determination of zinc in rubber products.[22] This is *p*-ethoxy phenyl azo-*m*-phenylene diamine (*p*-ethoxy chrysoidine), prepared by coupling the diazo product of *p*-phenetidine hydrochloride with *m*-phenylene diamine. This may be used in conjunction with potassium ferricyanide, as an internal indicator for the titration of zinc against potassium ferrocyanide. The *p*-ethoxy chrysoidine may be replaced by diphenyl benzidine, which is almost as satisfactory. Either method is to be preferred to the normal titration, using uranyl acetate as external indicator.

Apparatus

The construction of a recording automatic balance from an ordinary analytical apparatus and an automatic recording outfit has been described.[23] The set-up is recommended for following such processes as rapid corrosion, change in specific gravity, or for the measurement of hygroscopicity.

The advantages of the glass electrode as a reference electrode in electrometric oxidation-reduction and precipitation titrations have been detailed.[24] It is pointed out that when the *p*H remains reasonably constant the glass electrode, which requires very little preparation, is preferable because of its chemical inertness, avoiding contamination of the solution which is being investigated. This is of prime importance in argentometric titrations, where chloride contamination from the usual salt bridge is likely. In addition, the glass electrode potential, when the apparatus is used in varied solutions, is more reproducible than that of ordinary metal-salt electrodes. Elsewhere,[25] in a review of the testing of dairy products, the glass electrode is stated to be the most reliable standard for determining the *p*H of milk.

Chromatographic adsorption has found an application in the determination of carotene in silage.[26] Earlier methods, using phase separation, might give a final extract for the analysis which contained as little as 66 per cent. carotene, the remainder comprising xanthophyllic pigments which were separated along with the carotene. Following earlier work,[27] tests were carried out to compare the efficiency of (i) the old phase separation method, (ii) preliminary phase separation, followed by chromatography on a column of dicalcium phosphate, and (iii) direct chromatography without a preliminary separation. The results indicated that the third method gave satisfactory results, the xanthophyllic materials being adsorbed on the column; the filtrate then contained the carotene in a condition for a normal estimation.

For the microscopic examination and analysis of paint and rubber pigments, dispersion in a household cement of suitable refractive index is proposed.[28] The high viscosity of the medium provides a large shearing force for dispersing the pigment during mixing, while it also provides a large shearing force for dispersing pigment during mixing, while it also operates to prevent subsequent reflocculation. In addition, the mounts may be prepared so as to be permanent, and are ready for photomicrography after setting for half an hour. Photomicrographs of zinc oxide, iron oxide, and ground barytes illustrate the effectiveness of the method.

An interesting application of two analytical aids to an industrial problem is described in an investigation of the breakdown of paper dielectrics impregnated with chlorinated naphthalene and used with aluminium electrodes and d.c. current under heavy duty conditions.[29] Examination of the fluorescence in ultra-violet light, and development of the paper as contact prints with silver chromate and with phenolphthalein showed that the decomposition started at minute nuclei containing free hydrogen and chloride ions, spreading rapidly from these points. It was concluded that hydrochloric acid was split off from the chlorinated hydrocarbon, and that this attacked the aluminium electrodes. The aluminium chloride thus formed catalysed a further breakdown of the impregnant, so that the breakdown became progressively greater. Support was lent to this by the etching on the electrodes, and remedies based on these findings were suggested.

A practical review of modern analysis, as applied to foods, is illustrated[30] by reference to a number of specific examples, including the multiple analysis of benzoic acid in preserved food products, the determination of carbonate in baking powders and flours, the refractometry of sugars, and the control of the oxidation of oils and fats.

(*References, see p.* 32)

A CHEMISTS' BOOKSHELF

INTRODUCTION TO ATOMIC PHYSICS. By S. Tolansky, Ph.D. London: Longmans, Green. Pp. 343. 15s.

For once in a way the word "introduction" in the title to a text book is here thoroughly justified. Too often an "introduction" to a subject turns out to be an extensive and deep treatise introducing the reader to all the work and theories that have been propounded, presumably so that he may follow the subsequent researches which are yet to be published. This introduction to atomic physics is based on a series of lectures which for many years has formed part of a course given to second-year honours physics students at Manchester University. A good deal of the earlier portion of the book is customarily given as part of the normal physics text books, and in this portion which deals with the conduction of electricity through gases and electric discharge through gases of low pressures, the student will feel that he has his feet based on ground with which he already has some familiarity.

The book then deals with the charge and mass of the electron, positive rays, the quantum theory, thermionic emission, and photo-electricity, and so leads on to wave mechanics and the phenomena of radio-activity. Cosmic radiation introduces the reader to a fascinating chapter which is by no means closed and is perhaps hardly fully opened as yet. The nucleus of the atom is then considered and the book closes with a brief introduction to the theory of relativity. The treatment is clear and largely non-mathematical. The mathematics required are simple and should be well within the capacity of second-year students, not to mention older readers who have forgotten much of their more advanced mathematics.

This work can be thoroughly recommended as an interesting, well written, and adequately comprehensive introduction to a subject which has become of vast theoretical interest, and, in its application to certain branches of electricity, has assumed considerable practical importance. The treatment is entirely theoretical in the sense that no commercial or industrial applications are visualised. In the opinion of Professor Sir Lawrence Bragg, who writes a foreword, there has been a real need for a first introduction to atomic physics which will give the student a book of reference without taking him too far. We thoroughly agree with Sir Lawrence's opinion that "Dr. Tolansky has admirably supplied this need."

HOW MANY BEANS MAKE FIVE? By Lord Perry. London: The Individualist Bookshop. Pp. 46. 6d.

In another of those mind-jogging pamphlets published by the Individualist Bookshop, Lord Perry asks: "How Many Beans Make Five?" The nature of his reply to his own query is indicated in the chapter headings, which include: Purchase Tax, Income Tax, Food Prices, etc. The question is rhetorical; the answer is a commonsense examination of matters of importance to everybody. This is No. 17 in the series of "Post-War Questions."

SCIENCE FOR THE PROSECUTION. By Julius Grant. London: Chapman and Hall. Pp. 302. 15s.

Any effort to bring into closer contact the law and the physical scientist is laudable, serving as it does to dispel the cloud of suspicion in which "scientific crime detection" has been unjustly shrouded. Dr. Grant's book deals, *inter alia*, with forensic physics in such manifestations as fluorescence and the use of infra-red rays; with purely chemical methods, such as chemical microscopy (which, incidentally, he discusses as a "new" technique, forgetting that its foundations were well and truly laid in the last century), and with physico-chemical legal aids, such as spectroscopy. As one familiar with Dr. Grant's other publications would expect, the sections dealing with documents and with the use of ultra-violet light are particularly capably handled.

It is, however, the belief of the reviewer that a substantial enlargement of each chapter would more than double the value of the book, and cause it to appeal to a much wider reading public. The extra space should be devoted to more advanced discussion of the methods. Spectroscopy in crime detection, for example, has gained such a popular reputation that one feels it would have been wise to note more fully the limitations of the method, as well as to give a clearer indication of the various techniques employed by spectroscopists in different circumstances. It is dangerous to give the layman the impression that the scientist is almost a magician. Fuller reference to cognate reading would also be desirable. The book at present affords no means by which the many interesting cases quoted may be easily followed up. And the reading list given at the end of the book has some strange omissions. To specify only a few, there is no mention of such authorities as *Gross-Kendal, Söderman and O'Connell, Rhodes*, or, strangest of all, *Osborn's Questioned Documents*, a classic with which, surely, Dr. Grant must be thoroughly familiar.

A final word of praise is reserved for the introductory discussion of the aims and development of forensic science, and for the chapter on blood group tests. Both are excellently done. Dr. Grant's book, if somewhat expanded, would form an excellent companion to a volume by a jurist dealing, primarily for the benefit of his opposite number, with the limitations and barriers imposed by legal precedure on the forensic scientist.

Gas Producers, II

Purification and Transport Problems

from a Special Correspondent

(*Continued from* THE CHEMICAL AGE, *July* 4, 1942, *p.* 8.)

IT has been suggested that one method of avoiding clinker troubles, apart from reducing the temperature by addition of steam or by slowing down the producer, is to use smaller fuel. The greater the surface the less will be the cooling of any particular part of the surface due to the endothermic reactions and the greater will be the opportunity for the right reactions to take place. It may thus be possible to make equally good gas at slightly lower temperature owing to the greater opportunities for contact, and thus to reduce clinkering troubles. On the other hand a reduction in the size of the fuel, if it be accompanied by a partial reduction to the quite small sizes comprised in coke breeze, will slow down the producer seriously.

Use of the Poker

Where clinkering troubles are considerable the poker should be used to break up the clinker frequently. On the other hand, if there are not serious clinkering troubles, and if the coal is slightly coking, poking in the distillation zone will be most effective. The difficulty with using coking coals can also be obviated by charging into the producer a mixture of coal and coke. This is best done by charging in alternate skipfuls or in some other regular manner so that alternate layers of coal and coke are formed. This "sandwich" practice has been adopted with success also where the fuel has been too small. If it can be screened into two sizes, say ½"-0 and above ½", which are charged in alternate layers, much of the difficulty caused by dust deposition in the flues may be overcome. The difficulty of dust deposition has also been met by cyclone extractors. In general, dust below about 1 mm. in size generally finds its way into the flues and is of no value in the gas-making process.

The avoidance of segregation is also important because, if the larger fuel is allowed to fall towards the edges of the producer, as it would naturally do, there may be short-circuiting of the gases through the channel of least resistance. An increase of the size ratio from about 1" to 3" has been found to cause a decrease in the resistance of the cold producer bed from 4" to ¼" W.G.

In the relatively tiny traction gas producer the air or air-steam mixture is frequently injected by a nozzle, around which there is an intense temperature extending over quite a few inches. This avoids fusion of the brick lining of the producer and seems to be sufficient to enable good gas to be made. Naturally, the problems of keeping a small producer alight, often with intermittent operation such as is required for traction purposes, are very different from those of keeping a large producer in operation. The thickness of the several reaction zones is likely to be less. For this reason the reactivity and the size-grading of the fuel are both of the first importance, and so also is the character of the ash. Not the least of the problems of developing a satisfactory traction gas producer lies in the provision of adequate supplies of the necessary fuel. The curves given previously show the paramount necessity of a highly reactive fuel when working on so small a scale.

The purification of producer gas depends on circumstances, as has already been indicated. For large-scale work, if it is necessary for the gas to be cleaned, it must first be cooled. The cooling can be effected by evaporating water in the incoming fuel, or, if there is sufficient surplus heat, in waste heat boilers, both followed by direct water cooling. Special arrangements have to be made for the recovery of tar if coal is used, but if clean producer gas is required it is better to use coke in the producer. The only impurity then to be removed is dust. The dust is usually removed by washing the gas with fine jets of water, but other well-known means can be employed.

Avoiding Cylinder Wear

For the traction gas producer a much greater degree of purification is necessary in order to avoid engine cylinder wear, blockage of the filters, gumming of valves, and other troubles which upset the operation of a small engine. The gas must be cooled and freed from water, or the power from the engine will be proportionately reduced. The problem of gas purification and filtration is not yet solved and is perhaps the outstanding difficulty in traction gas work. The paper by Dr. Ward and Mr. Morison to which reference has been made has introduced the principle of wet scrubbing of the gas because it has been found that the cylinder wear in engines is primarily due, not to abrasion by small amounts of

relatively soft fine dust which pass the fairly efficient commercial filters, but mainly to the corrosive action of gaseous impurities in the gas which such dry filters cannot arrest. The gaseous impurities may corrode cylinders in at least two ways: corrosion by ammonia and sulphur compounds soluble in water which may be deposited on cylinder walls, and by sulphuric, nitrous, and nitric acids formed in the cylinders by the combustion of the sulphur and ammonia impurities in the presence of water. The authors point out that the gaseous impurities are formed mainly within the fire-bed, usually from sulphur and nitrogen compounds occurring in the fuel itself. The reactions are complex, and are not fully understood. Sulphur compounds in the coal may yield: (*a*) on distillation, such products as sulphuretted hydrogen, carbon disulphide, etc.; and (*b*) on combustion, sulphur dioxide (with perhaps a little sulphur trioxide).

Sulphur Compounds

Under the conditions existing in the fire-bed, sulphur dioxide may undergo reduction in accordance with equations similar to $SO_2+C=CO_2+S$, the CO_2 then, possibly, reacting with carbon to yield CO. Another reaction which occurs is: $CO+S=COS$. The yield of COS above 800° C. in the presence of carbon is very small, but in the comparatively cool zone between the fire-bed and the gas off-take, and during gas cooling, the extremely rapid reaction: $CO+S=COS$ may occur. Similarly, CS_2 may be formed by interaction between SO_2 and C in the cool zones. In addition, the reaction: $SO_2+2CO=2CO_2+S$ takes place at the fuel surface and is catalysed by fuel ash. The proportion of SO_2, CO, CO_2, and S in the equilibrium mixture is a function of both temperature and pressure.

Hydrogen sulphide and other sulphur compounds formed by distillation of the coal may pass unchanged to the coolers, or part may be burned to SO_2 thus: $2H_2S+2O_2=2H_2O+SO_2$, and the SO_2 formed may enter into reaction with C or CO as indicated above. Hydrogen sulphide, carbonyl sulphide, carbon disulphide, and other sulphur compounds are formed under some of the wide variety of conditions which may exist in and near the producer fire-bed. Some of the sulphur compounds may be "fixed" by constituents of the ash; the proportion so fixed is a function of the fire-bed temperature, time of contact, ash composition, etc., and can be increased by addition of basic materials such as soda ash or lime to the fuel. Similarly, the nitrogen of the coal may find its way to the gas in a variety of forms, including ammonia (free and combined), cyanogen compounds, etc., or as free ntirogen.

Figures given in the paper referred to show that, by wet washing, cylinder wear has been reduced to such an extent that whereas some 160-600 miles could be run with wear of 0.001 inches it is now possible to run from 3000 to over 5000 miles for the same wear. The whole of this improvement has not been due to wet washing. It is estimated that 1000 miles of the improvement has been due to the introduction of upper cylinder lubrication. Considerable improvements have resulted from the work initiated by Thomas Tilling, Ltd. Although the addition of steam to the blast improves the calorific value of the gas it has been found that for practical reasons dry blast is to be preferred to wet blast for passenger-service vehicle operation.

The account here given of the operation of gas producers, both for industry and traction purposes, indicates the importance of scientific investigation of this peculiarly chemical apparatus. It suggests that one result of the war, during which industrial producers have often to use unsuitable fuels, and of the great attempts being made to develop a satisfactory traction gas producer, will be to lead to a greater knowledge of the essential factors of producer operation and to reduce what was formerly very much a rule-of-thumb process to one of a highly scientific character responsive to scientific control. Given suitable fuel, large producers present few unsolved technical problems. The war-time difficulties arise from unsuitable fuel. Successive deliveries may vary widely, and this necessitates analytical examination by proximate analysis, screening, etc., to ascertain in advance what difficulties are likely to occur.

Producer-Gas Difficulties

Coals too highly coking: poke the distillation zone frequently, allow to weather for a few weeks if possible, or mix with coke nuts of "broken coke" size, or non-coking coal.

Ash too fusible: poke the ash zone frequently; mix with weight equal to ash content of silica sand; or as a last resort increase blast saturation temperature a few degrees.

Coal too fine: use cone dust extractor on hot gas; screen out dust below ¼" and use under boilers; reduce throughput of producers; screen into two sizes and charge in "sandwich" system.

The problems of the traction gas producer are (1) the supply of adequate quantities of suitable fuel at reasonable prices; and (2) the chemical purification of the gas by methods suitable and effective on a small scale and with chemically unskilled labour.

Chemical Compounds for Insecticides

Recent American Researches

FOR many years Bordeaux mixture, and other copper sprays, have been universally accepted for the control of plant diseases, and because of the effectiveness of Bordeaux mixture in particular, little has been done to develop alternative fungicides. Because, however, Bordeaux mixture and most of the other copper sprays may, under certain conditions, cause serious damage to peach, plum, cherry, apple and other fruit trees, most of the substitute fungicides which have appeared have been for use on these trees. Prominent among these substitutes is lime-sulphur solution, but in the case of such diseases as grape black rot and various diseases of citrus and other subtropical fruits, Bordeaux mixture is essential—there is, in fact, no substitute for it. As things stand at present, therefore, practically the only fungicidal sprays that have even partially supplanted copper within the past 30 years are lime-sulphur solution and elemental sulphur. In the case of zinc, so far no effective substitute has been found to replace the usually cheap zinc for use in the control of peach bacterial spot and as a "safener" for arsenate of lead sprays on peach.

Development of Organic Fungicides

In recent years, however, much progress has been made in the development of organic fungicides, and it seems probable that within a comparatively short time fungicides of this type will be in use which will be as effective as the inorganic materials of to-day, and will prove less injurious to plants. Mr. John W. Roberts and his associates at the Bureau of Plant Industry, U.S. Department of Agriculture, have tested several hundred organic materials, most of them supplied by chemical manufacturers and by the Insecticide Division of the Bureau of Entomology and Plant Quarantine, and the following is an extract from a recent paper on the subject by Mr. Roberts (*Ind. Eng. Chem.* 1942, *34*, 4, 497).

Of the materials tested, phenothiazine is one of the most promising; it has given fairly good control of apple scab and some indications that it may control bitter rot. It has been reported as delaying maturity of apple fruits, but in our experiments in the East and Middle West the fruits have appeared normal and free from injury. It has also controlled mild cases of cherry leaf spot. Its principal weakness appears to be lack of adherence which, however, has recently been greatly improved by finer grinding. If this product adhered better, was effective over a longer time, and could be produced cheaply in large quantities, it might be developed into a practical fungicide. At present it is made only in small quantities and its price is prohibitive.

Dinitro compounds may also form the basis of successful fungicides. The water-soluble sodium salt of dinitro-*o*-cresol has been shown to eliminate infection sources by killing fungi in fallen leaves, and has killed fungus galls on cedar trees. The dinitro compounds are injurious to plants in active growth in varying degrees but some other salts or carriers may be found that will make at least one of these compounds a successful summer spray.

Thiuram Disulphides

The thiuram disulphides also show some promise, and are worthy of further experimentation as orchard fungicides. In our experiments tetramethyl thiuram disulphide has been toxic to fungus spores, but has caused injury to fruit and foliage of apple, peach, and cherry trees when combined with lime and lead arsenate. It has recently been reported as successful in the control of turf diseases.

The diphenylamine derivatives have shown some promise but do not appear to be equal to fungicides now in use; 2,4-diaminodiphenylamine has provided some control of apple and peach diseases, but it is easily washed off by rain.

The thiocarbamates are promising fungicides and may eventually become useful. Ferric dimethyl dithiocarbamate has one advantage over all the other organic chemicals tested in that it spreads and sticks well. At the time this is written, before the end of our first season's test, it appears to have controlled apple scab, but examination will be necessary before it can be certain that scab has been controlled.

At present there are no chemicals or

combinations of them that can be utilised as fungicides to any great extent where copper is now used. If growers of most of the principal fruits and vegetables are to raise their crops free from disease, they must, except in certain favoured sections, apply copper sprays.

No doubt many other organic materials have been found that are considered promising. In this article the author has confined himself to those that have been tried; many have failed either because they would not kill fungus spores or because they injured the sprayed plants.

We think of copper as a common substance, always obtainable. Perhaps its threatened shortage will stimulate chemists and phytopathologists to seek more diligently for successful organic fungicides.

Synthetic Organic Compounds

The synthesis and testing of organic compounds as insecticides has been an important activity of the U.S. Department of Agriculture since 1932. During this time about 2000 materials have been prepared and tested. Observations are recorded as to the effect of the compound upon the foliage of plants, and material is sent to the Bureau of Agricultural Chemistry and Engineering for pharmacological testing, since the object is to develop new insecticides that are less hazardous to man than the present widely used arsenical and fluorine compounds. Mr. L. E. Smith of the Department's Bureau of Entomology and Plant Quarantine has been engaged on this work, and the following conclusions regarding some of the materials tested have been abstracted from a recently published article by his hand (*loc. cit.*, p. 499).

Anabasine

β-Pyridyl-α -piperidine (Neonicotine) was found by Smith, Richardson, and Shepard to be the toxic ingredient of the reaction product of sodium and pyridine. Subsequently Russian chemists found it present in the optically active form in a weed belonging to the sugar beet family (Chenopodiaceæ), and was called "anabasine." This is an excellent contact insecticide, being four or five times as toxic as nicotine against certain aphids.

Phenothiazine was first prepared as a possible insecticide in 1934. Laboratory tests indicated that the compound not only was more toxic than rotenone to mosquito larvæ, but was fully as effective as lead arsenate in controlling codling moth larvæ. It has also been found to be toxic to the tent caterpillar, the Mexican bean beetle, the grape-berry moth, the European corn borer, the screw-worm, and several other insects of economic importance. In common with other organic insecticides, phenothiazine is specific in its insecticidal action. It is available in large quantities at reasonable cost, and has been tested under field conditions for several years, especially for the control of codling moth larvæ. It is believed that, when proper methods of application have been worked out, phenothiazine may replace lead arsenate for the control of this insect, in some areas at least. In addition, it also has fungicidal and anthelmintic properties.

Tests have also been made with 1,4-diphenyl semicarbazide, *p*-aminoacetanilide, phthalonitrile, *ortho-*, *meta-*, and *para*-nitrophenyl iodochlorides, 4,6-dinitro-*o*-cresol acetate, azo compounds, and fluorene and its derivatives, but so far these have not been used to any great extent outside the laboratory, further tests being in many cases necessary.

Recent Developments in Analytical Chemistry

(*Continued from page 27.*)

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Synthetics in the Varnish Industry

Use of Hydrogenated Solvents

by A. E. WILLIAMS, F.C.S.

SIMULTANEOUSLY with the development of artificial resins in the varnish industry has arisen a series of hydrogenated products as solvents for them. These solvents impart special properties to the resin varnish. Without them some of the varnishes now on the market could not be made, because the best type of resin for a specific varnish is not always applicable to the most appropriate solvent hitherto available.

Hexaline

Hexaline, or hexahydrophenol, produced by the hydrogenation of phenol, represents one of these modern solvents. It is a colourless neutral liquid, boils at about 156° C., has a specific gravity of about 0.94, and besides having a high solvent capacity for resin is particularly suitable for maintaining homogeneity in a clear varnish. For when several solvents are present in this, either turbidity or separation of the solvents one from the other may occur. The addition of a few per cent. of hexaline prevents this. Methyl hexaline (methyl cyclohexanol) from the hydrogenation of cresol, has similar properties to hexaline; but its specific gravity is slightly lower, whilst its boiling point is higher, being about 165°-175° C. It produces thinner varnishes than hexaline, but in other respects it is very similar, and would be used generally only where a favourable price differential exists. Frequently methyl hexaline is dearer than hexaline owing to the higher cost of cresol.

Naphthalene Solvents

Naphthalene, when hydrogenated, gives two solvents of interest in synthetic resin varnishes. These are tetrahydronaphthalene, in which only four atoms of hydrogen are added; and decohydronaphthalene, which is completely hydrogenated and is as a consequence more stable. The trade names for these solvents are tetraline and decaline respectively. Tetraline has a boiling point of 200°-210° C., and a specific gravity of about 0.972; the corresponding figures for decaline being 180°-190° C., and 0.893. The former solvent does not dissolve resins of the phenol-formaldehyde type very readily in the cold, but the action is facilitated by heat. Both of these solvents produce, in general, a varnish of slightly less viscosity than the older solvents, but the life of the dried films compares favourably. In practice a better result is often obtained by using a partially hydrogenated product, consisting chiefly of a mixture of tetraline and decaline. When making spirit varnishes with these solvents the proportion of resin to solvent is 1 : 2, sometimes 1 : 2½. A feature of these solvents is that their relatively high boiling points facilitate the mixing, under heat, of the solvent and resin without undue loss of solvent.

Coumarone Resins

For some years coumarone resins have been applied to both spirit- and oil-varnish making, but not always with success. A spirit varnish made from the resin may give poor results because of the solvent used. This is frequently noticeable with solvents like benzine or solvent naphtha, which produce with the resin a film which is still soluble in the solvent, and therefore unsuitable for multiple-coat work, because the primary coat is softened and dissolved by the succeeding one. In an appropriate solvent, however, coumarone resins are very efficient and may be used for outdoor work and also for resistance to chemical action. Probably the largest outlet for this class of resin is in the making of oil varnish. The resin has a high solubility, under heat, in linseed oil and in tung oil, as well as in the semi-drying oils such as soya-bean oil.

Oil-Varnish Manufacture

In making oil varnish the procedure follows well-known lines, with the exception that the resin is heated *with* the oil to 260°-270° C., with frequent stirring for a period up to about one hour. A small proportion of the usual driers is added and, in order to maintain homogeneity as well as to shorten the drying time, one of the hydrogenated solvents may be used with advantage. This solvent replaces a part of the linseed oil or other oil normally used, and may form from 20 to 30 per cent. of the total solvent present. Generally speaking, the lighter-coloured resins are the most expensive, particularly if these are hard, which is not always the case. On the contrary a dark-coloured resin, which has a high softening point (over 50° C.) commands a good price for use in black enamels. The varying degree of colour in these coumarone resins depends not so much upon the raw material, solvent naphtha, used in their manufacture, as in the care taken to eliminate undesirable acids and bases before polymerisation, and on the strict regulation of processing temperatures. While most of the commoner solvents, turpentine, hydrocarbons, amyl acetate, carbon tetrachloride, trichlorethylene, etc., in addition to the hydrogenated solvents, readily dissolve these resins, ethyl alcohol has only a very low solvent effect on them. A typical resin

spirit varnish suitable for indoor work is prepared by simply dissolving, according to strength required, the appropriate amount of resin in a solvent, and allowing to stand for some considerable time before straining if necessary. Coumarone resin dissolved in tetraline alone gives a film which dries completely within one hour without the assistance of extraneous driers. Good results are also obtainable when one of the hydrogenated solvents is used with one of the older solvents, with the exception of turpentine and tetraline; for these two used alone invariably give poor results, due to uneven drying. The speed of drying, or rate of evaporation, may be varied, of course, within wide limits by mixing the various solvents in different proportions. One typical formula for making black enamel from coumarone resin for coating metal work is prepared as follows: Black coumarone resin 4 parts by weight, asphalt 2 parts, tung oil 3 parts, tetraline 10 parts. The resin is first dissolved in the tetraline, the asphalt is heated with the tung oil, and the two mixed after cooling. A varnish in demand to withstand sea water is made up of coumarone resin about 6 parts by weight, hexaline 4 parts, linseed oil 2 to 3 parts, benzine or other hydrocarbon solvent 1 to 2 parts.

Insulation Varnish

Synthetic resins concerned in electrical insulation varnish are usually either phenol-formaldehyde or aldehyde products. The former probably give better service under most conditions, for they have a high resistance to oils and heat. But often when resistance to chemical corrosion is necessary the aldehyde products have the advantage. Aldehyde resins normally are manufactured from acetaldehyde, and the condensation agent may be either an acid or an alkali, the latter giving the best insulating properties generally. In addition, aldehyde resins produced with an alkaline agent have the best resistance to attack by chemicals, including strong caustic soda and mineral acids. These resins are extensively employed as a binder for an inert filler in cable manufacture, in the production of micanite, and in coating paper and fabric insulation for cables and other electrical goods. In this respect they are much cheaper than varnishes produced from natural materials, and comparative tests show that on coated paper their dielectric strength is from 10 to 20 per cent. higher than that obtainable with natural products. It is obviously an essential that in resins intended for insulation work no trace of the condensing agent or other electrolyte should remain. For this reason the resins are invariably put through purifying processes to eliminate such electrolytes.

The solvent used for these resins must leave no residue on evaporation, and should preferably give a quick-drying film. Of the hydrogenated hydrocarbon solvents, a mixture of equal parts of hexaline and decaline is here the most suitable. This solvent mixture has a much greater solubility for the resin than either turpentine or linseed oil, the solvents hitherto used; but its relatively low flash point, about 65° C., renders it unsuitable for some insulating processes. For general insulating work it can be advantageously used by dissolving the resin in a minimum amount of hexaline with decaline and then thinning down with raw, not boiled, linseed oil. As this solvent mixture dissolves from 5 to 10 times as much resin as an equal volume of either turpentine or linseed oil it is an economical method of bringing the resin into solution. Such a varnish dries within 4 to 5 hours; quicker drying results by adding driers, but this is usually at the expense of the insulating value.

Phenol-Formaldehyde Resins

The raw materials for these, as is well known, may be commercial carbolic acid or cresol on the one hand, and an aqueous solution of formaldehyde or a compound such as hexamethylenetetramine. For varnish making, resins of the fusible and permanently soluble class are used, as distinct from those used in the moulding industry. The raw materials, in the proportion of one part of formaldehyde to two of phenol, are condensed with substances of an acid character. If intended for spirit-varnish making, brittleness in the dry varnish film may be obviated by modifying the polymerisation process during the manufacture of the resin. Briefly, this consists of replacing a part of the polymerising agent with the unsaturated fatty acids of vegetable oils. These resins simulate shellac probably more closely than any of the other artificial resins. Some of them even have the property of being peptonised by alkalis, as in the case with shellac, for use in the textile trades, ink industry, etc. Tests have shown that these resins when merely dissolved in one or more of the hydrogenated solvents, without the addition of any drier, give a film that dries within four hours. The durability and finish of these varnishes is generally acknowledged to be at least equal to a shellac spirit varnish. For out-door work an oil varnish is prepared without any troublesome "gum running" process with its attendant losses, by first dissolving the resin with slight heat in a minimum mixture of hexaline and decaline solvents before incorporating the oil and other desired ingredients. This solvent mixture also permits of the addition of non-solvents to the varnish without resultant turbidity.

Resins of this class are now manufactured for the purpose of making protective varnish

for storage tanks, etc. The resin is dissolved in a mixture of hexaline, decaline, and ethyl alcohol in various proportions ranging from one of resin and four of solvent to equal parts of the two. The varnish so made has special applications for the lining of vessels to hold various coal-tar derivatives, petrol containing tetra-ethyl lead, and other petroleum products. In the petroleum and coal-tar industries this tank-lining material has become very popular in the past few years. Generally, the varnish is made in various strengths to suit different purposes; each grade being distinguished by adding a small proportion of a specifically coloured pigment. This varnish is also used for lining packages such as cans, drums and barrels, and against corrosion from water other than sea water.

Lacquers

Artificial resins now play an important part in the manufacture of lacquers, and so economical has technique become that at the outbreak of the present war the popular sixpenny stores were offering a can of good quality material for sixpence. In many cases the synthetic resins substantially replace the more costly materials hitherto used, thus allowing other solvents, generally cheaper, to be used. One of the new solvents developed for this purpose is hexaline acetate, prepared by the esterification of hexaline. With the exception of its boiling point (about 180° C.) hexaline acetate is very similar in properties and behaviour to butyl acetate and amyl acetate, and readily dissolves nitrocellulose. While it is not easy to give a definite proportional formula for a typical lacquer of this kind, owing to the varying qualities of the constituents, a general outline is as follows: Nitrocellulose is dissolved in a mixture of hexaline acetate and hexaline. Another solution is made up of hexaline and coumarone resin; and a third solution of ethyl alcohol and phenol-formaldehyde resin. For the coloured lacquers the required pigment or dye is incorporated with one of these solutions. These three solutions are next mixed together in proportions depending on lacquer strength and drying period required. Usually, the nitrocellulose forms rather less than one-third of the total solids. In such lacquers hexaline is said to prevent "blushing" of the film even under the most unfavourable conditions, and to impart an even flow during application of the lacquer.

Chemists and Coupons

Help from the Institute

THE Board of Trade has arranged that where laboratory or industrial chemists have expended more than twelve coupons on overalls during the year ending May 31, 1942, they may claim a rebate of coupons expended in excess of that number. For the present, such claims supported with bills, should be sent: by members of the Institute of Chemistry to the Institute, and by members of the British Association of Chemists, or by chemists who are not members of any organised body, to the Association. No claims may be sent by chemists who have received extra coupons under any of the Board's award of supplementary coupons. The Board is also considering the special clothing needs of chemists in respect of the next rationing period, and a further announcement will be made in due course.

The Board has further considered the problem of the replacement of clothing destroyed by industrial accidents and has now decided that, where a worker's clothing—whether his own or whether supplied by his employer—*is irreparably* destroyed by accident resulting from his work, coupons will be granted for its replacement, subject to the following arrangements being complied with, viz.:

(1) The employer of the worker concerned will be required to make an application for the necessary coupons giving the following particulars: (a) the exact quantity and nature of the clothing destroyed; (b) the exact nature and circumstances of the accident and date; (c) a statement by the employee that he has not and will not make any other application for coupons in respect of the loss.

(2) With a view to facilitating the prompt handling of these applications the Board is prepared to allow such applications to be dealt with by employers' organisations on behalf of their constituent firms.

The Board has agreed to consider the Institute of Chemistry as an "Employers' Association" for the purpose of the above scheme, in respect of any Fellows or Associates who are employers but do not belong to any other such organisation. It is expected that this may prove useful to consulting chemists or other members working independently.

THE REPUBLIC CHEMICAL CORPORATION, 94 Beekman Street, New York, U.S.A., has published a leaflet giving advice to its customers on how to obtain their products in war time. The corporation points out that applications for permission to export certain "critical materials" must definitely establish the urgency of the need for such shipments; a Certificate of Necessity must be obtained. A list of about forty chemicals whose export requires a Certificate of Necessity is set out

The French Chemical Industry

Utilisation of New Raw Materials

ACCOUNTS for 1941, published by leading French chemical companies during the past few months, have mostly shown a considerable increase in profits which, however, was due mainly to the advance in prices and the consequent gains from the realisation of stocks. Industrial operations were in general not extended, and shortage of fuel and raw materials has compelled some sections of the French chemical industry to work shorter hours or even to close down part of their plants. One report states that these shortages have brought about the closing of 1350 factories. The disposal of pre-occupation stocks has by now gone so far that in important sections of the chemical trade supply is far below demand, and new ways have to be found to satisfy essential needs, a state of affairs reflected by a large increase in liquid funds. In spite of this, however, few companies have increased their dividends; many, indeed, have increased their capital because their funds were not sufficient to replace stocks at the higher prices of to-day and to make the new investments necessary to start substitute productions.

Metallurgy

Ugine and Péchiney, with their large metal interests, both reduced their dividends, to 13 (15) per cent. and to 10 (15) per cent., although their net profits had advanced considerably. The French aluminium industry is in a comparatively favourable position because it can rely on local raw material and enjoys preferential treatment in power supply; the output of aluminium is said to be now about 50 per cent. above pre-war figures. Société d'Aluminium has raised its capital from 30 to 100 mill. frs. and Société du Duraluminium from 63 to 126 mill. frs. A concession for the exploitation of lead and zinc ore at Carcassonne (Aude) has been given to the Société Minière de la Lombatière, and St. Gobain has applied for a concession over pyrites and iron sulphides.

The coal-mining industry has received a great stimulus from the interruption of Welsh supplies, and numerous new concessions have been issued in various parts of France. The old mining companies have not only endeavoured to increase their output, but have also made large investments in coke-oven and by-product recovery plant, with full Government support. Meanwhile, more attention has been paid to lignite mining in Central and Southern France, and oil plants to treat lignite and shale have been, and are being, built. The Société Manière des Schistes Bitumineux is building a shale distillation plant at Autun, which will ultimately have a daily capacity of 2500 tons of shale, and the Société des Combustibles et Carburants Nationaux is building a carbonisation plant for lignite and shale at Mireplisset (Aude), which will later use 1000 tons of lignite daily. Besides the synthetic plant at Aix-en-Provence, which we have already described, at least three companies are engaged in oil exploration work, mainly in Aquitaine. These developments are, however, of little immediate importance; only the Autun plant seems so far to be in actual operation, and the output there cannot yet be large.

New Fuels

No less than 43 new plants are to make charcoal to be used as gas-producer fuel, and some of these will also produce methyl alcohol, wood tar, etc. The production of ethyl alcohol from sugar-beet is to be raised by 20 per cent. this year, and several new enterprises have been formed for the exploitation of the extensive peat deposits. Other mining developments concern potash and sulphur. Besides the shaft sunk at Boudigot (Landes), already mentioned in our columns, the Société de Potasse et des Engrais Chimiques is to open up a large sulphur deposit near Narbonne, while St. Gobain and Alais, Froges, et Camargue are also working sulphur deposits.

Among industrial developments of chemical interest which are not concerned directly with the opening of new raw material sources few are of sufficient importance to warrant notice. Dunlop have announced the intention to make synthetic rubber, apparently on the basis of anthracene, of which there is a substantial production in France, Rhône-Poulenc have started the production of nylon, as already indicated, and the Société Maubeugeoise de Gaz Comprimé has been formed by several glass interests. The expansion in the synthetic fibre industry must be regarded as part of the effort to extend the raw material basis. France Rayonne, which co-operates with German cell wool companies, proposes to use reed for the production of textile cellulose. Even the increased interest shown in the North African possessions is due to a desire to find new raw materials; it is hoped to find there some of the lacking minerals, and great schemes have been evolved for the exploitation and distillation of vegetable oils, not only for the soap industry, which urgently needs more raw material, but to extend the supply of motor fuels.

Expansion generally has been greatly hampered by the difficulty of obtaining plant and equipment. Only the smaller schemes for an extension of operations where production is already substantial have any prospect of early realisation.

Catalytic Activity

X-Ray Patterns of Metal Catalysts

SOME illuminating observations on the physical basis of catalytic activity have recently been reported from a meeting on heterogeneous catalysis held in Moscow. A. M. Rubinstein determined the X-ray patterns of some catalysts used for hydrogenation, dehydrogenation, or dehydration of alcohols and other organic compounds, and compared the results with the catalytic efficiency of the same samples. The spacings of the X-ray lines are a measure of the spacings of the crystal lattice, and the sharpness of these lines depends on the size of the micro-crystals of which the specimen consists. Rubinstein found that the lattice spacings of nickel catalysts were slightly different from those of ordinary nickel, and that the temperature coefficient of dehydrogenation of alcohols in the presence of a catalyst was the higher the more compressed was the lattice.

A similar observation was made by D. Y. Gamburg: iron catalysts (as used for ammonia synthesis) had the normal spacings of microcrystalline α-iron, if they had been obtained by reduction of ("promoted") ferric oxide at 700° C.; and they were almost inactive. Very active iron catalysts prepared at 400° C. showed an unmistakable deformation of the lattice. The average size of the iron crystals was identical for specimens reduced at 400° C. and those reduced by 700° C.; the loss of activity could not, therefore, be due to a change of fineness.

The effect of fineness on the activity of catalysts was estimated by Rubinstein. By means of X-rays he measured the average particle size of 13 nickel-alumina catalysts of a constant composition. The catalytic activity in respect to dehydrogenation of alcohols showed a maximum when the particle size of nickel was 70-75 A.U., and the position of the maximum was independent of the temperature at which the catalyst was used. When pure nickel catalysts were investigated, it was found that their activity rose with particle size up to 80-85 A.U.; no coarser catalysts were available. The maximum at 70-80 A.U. was found again when, instead of alcohols, cyclohexane or formic acid was hydrogenated. Very different behaviour was noticed when nickel was employed for hydrogenation; both the hydrogenation of benzene at 155°-175° C. and the transformation $CO \rightarrow CH_4$ were more rapidly accelerated as the particle size decreased; the range of particles available was 40-120 A.U.

Rubinstein measured also the efficiency of a series of nickel-alumina catalysts in which the ratio Ni : Al_2O_3 varied within wide limits. The specimens containing one atom of Ni for one molecule of Al_2O_3 showed the highest activity for dehydrogenation or dehydration of alcohols at 200°-240° C.

SCRAP METAL COLLECTION

In the House of Commons recently, Mr. E. Williams asked the Parliamentary Secretary to the Ministry of Works and Buildings the total tonnage of scrap which had been obtained; and the sources from which it had been obtained.

Mr. Hicks, in reply, stated that the total tonnage of metal scrap obtained through action taken by his department to augment normal trade supplies was now over a million tons, of which railings had provided no less than 200,000 tons. The other sources of supply were steel from buildings damaged by enemy action and from the "national survey," which included the metal from dumps, collieries, railways and similar undertakings. To manufacture a million tons of metal it would have required three million tons of iron ore and two million tons of coal. Therefore important shipping and transport space has been saved, together with much valuable fuel.

These are encouraging figures, for a cursory glance round reveals many more railings available, and much steel still to be salvaged from bombed buildings.

VERTICAL RETORTS

The British Standards Institution has this month issued B.S. 1034, Test Code for Continuous Vertical Retorts, a further code in its series of test codes. The code contains all the necessary provisions for the experimental determination of the yields and qualities of the main products, together with full explanations of how these should be measured, and serves the purpose of checking guarantees as between the contracting parties in the construction of a new plant, under four main heads, the fulfilment of which is usually accepted as implying that a carbonising plant has satisfactorily passed its guarantee test.

As in the case of the other test codes, the code is divided into the following sections: Plant performance data relating to material supplied; data relating to the products; and carbon balance. It is followed by appendices on guarantees and guarantee tests and method of temperature measurement. Copies may be obtained from the Institution, 28 Victoria Street, London, S.W.1 (post free, 3s. 10d.)

Personal Notes

MR. GEORGE EDWIN BAILEY, director of Metropolitan-Vickers Electrical Co., Ltd., has been awarded the honorary degree of M.Sc., at Manchester University.

DR. LAWRENCE BASS, assistant director of the Mellon Institute since 1937, has been appointed director of the New England Industrial Research Foundation, Inc.

MR. H. R. THURLOW PRIOR, MR. A. H. JOHNSON, O.B.E., and MR. A. VAN BEUGEN BIK have resigned from the Board of Lacrinoid Products, Ltd., and MR. T. L. HORABIN, M.P., and SIR LOUIS STERLING have been elected chairman and deputy chairman respectively. MR. ALEXANDER BERNSTEIN, founder of the business, continues as managing director.

LIEUT.-COMMANDER E. BASIL GREEN, R.N., assistant managing director of the Royal Doulton Potteries, has been appointed Deputy Regional Commissioner for Civil Defence in the S.E. Region. Lt.-Commander Green, who served as Staff Officer to Captain Lord Monsell, R.N., in 1939-40, was released from active service, at the request of the Ministry of Supply, to return to his company to assist in dealing with production.

CAPTAIN ARTHUR ELWOOD HUFF, United States Army, who was cited in despatches from the Philippines for the restoration of the American flag to the top of the flagstaff at Corregidor in the face of heavy shelling and dive-bombing, is a young chemical engineer from St. Louis, Missouri. Since his college days he had been working in the Monsanto laboratories, and his most recent civil employment was as a research worker in the Monsanto organic chemical division.

The British Empire Medal has been awarded to MR. EDWIN ALFRED EVELEIGH, fitter, of Exeter, for courage, resource and devotion to duty in averting a serious fire when an oxy-acetylene cylinder valve burst and the escaping gas became ignited; also to MR. GEORGE HENRY LAWSON, senior overlooker at a Royal Ordnance Factory. When, as a result of an accident, igniters and cordite were set on fire, Mr. Lawson, though severely burned, helped to man a hose immediately after his escape from the burning building. He remained at his post, showing great fortitude and devotion to duty, until he was removed to hospital.

Obituary

SIR DANIEL HALL, K.C.B., D.Sc., F.R.S., who died in a London nursing home on July 5, aged 78, was one of the leading agricultural scientists in the country, and the maker of modern Rothamsted. A Lancashire man, he was educated at Manchester Grammar School and at Balliol College, taking a first-class chemistry degree at Oxford in 1884; he was thus able to view agriculture from the chemical point of view. It was largely owing to his influence that Wye College in Kent was started in 1894, and, with his appointment to Rothamsted in 1902, the modern activities of that research station received a tremendous impetus. When he left in 1912, on his appointment as principal of the Agricultural Development Commission, Rothamsted was firmly established as the hub of agricultural science in this country. Sir Daniel Hall was tireless in presenting the case of agriculture from the scientific point of view in letters to the Press; the volume of his formal published works was not large, but his most important work, "Digressions of a Man of Science," was appreciated by a scientific and general public far wider than those interested in his great technical achievements, many though these were.

BRIGHT NICKEL ELECTRODEPOSITION

Solutions employed in electrodeposition of bright nickel are very sensitive to impurities. Stepanov and Lyashchenko (*J. App. Chem. Russ.*, 1941, *14*, 281) have worked out a composition which, it is claimed, is as reliable as solutions used for dull nickel plating. By their method 32 g. of naphthalene are sulphonated with 45 c.c. of sulphuric acid at 180° C.; the reaction product is made partly to dissolve some nickel hydroxide and partly to react with ammonia. The plating solution contains 5-6 g. of Ni, coupled with sulphonated naphthalene, 1 g. of the substances produced in the reaction with ammonia, 25-30 g. of nickel in nickel sulphate, 25-30 g. of boric acid, and 10-15 g. of sodium chloride per litre. The *p*H of this solution is 4.5-4.7; it increases in the course of plating about as rapidly as that of the electrolyte, giving dull deposits. Bright plating takes place as long as the cathodic current density remains below 1.25 amp. per sq.dm. without stirring, or 2.5 amp. per sq.dm. with stirring. Low temperatures (20-25° C.) favour the brightness. The cathodic current efficiency is 90-96 per cent.

The bright nickel coating on steel is slightly less porous than the dull; the number of pores per sq. cm. was, for instance, 41 and 44 in a coating 8μ (=0.00032 in.) and 0.2 and 2.0 in a coating 25μ (=0.001 in.) thick. The corrosion resistance of the bright nickel coated steel in laboratory air surpasses that of steel plated with dull nickel; the potential difference between steel and bright nickel is less than that between steel and dull nickel. The bright nickel coating passes the standard tests for adhesion to steel and brass surfaces.

General News

From Week to Week

Meetings of Eire farmers have been urging the Eire Government to take some action to get fertilisers imported. Saltpetre has been offered in the black market in Eire at £17 per ton, and sulphate of ammonia at £52 10s. per ton.

The Food Ministry is planning to have British restaurant meals scientifically analysed, according to Mr. William Mabane, Parliamentary Secretary to the Ministry, as part of their policy to make British restaurant meals as healthy and nourishing as war-time supplies will permit.

When the publishers of so many annuals have found it necessary to increase their prices still further, we note with pleasure that the 74th edition of "The Chemical Manufacturers' Directory"—which is printed and published by Messrs. Newnham, Cowell and Gripper, Ltd., 21 City Road, London, E.C.1—remains at 5s. 6d. (the price was increased by 1s. last year). The book itself, which is still the same invaluable guide to chemical manufacturers, their addresses and products, is obtainable from all booksellers, price 6s. post free.

The Board of Trade has issued the Export of Goods (Control) (No. 28) Order, 1942 (S.R. & O. 1942, No. 1251), the chief effect of which is to consolidate previous Export Control Orders. The new Order comes into force on July 15, and sets out the position with reference to Export Licensing Control at that date. Changes have been made in the list of "all goods" destinations and in the provision under which certain goods may be exported through British Indian ports for transit overland to destinations in China. Copies of the Order are now available (price 8d.).

The value of certain plants for medicinal and industrial uses was pointed out recently by a representative of the Department of Health for Scotland. Nettle leaves, he said, are a rich source of chlorophyll, which is being used in industrial processes; foxglove leaves provide digitalin, which is used in the control of heart diseases; the vitamin C content of Scottish rose-hip syrup is far greater than any obtained from oranges or blackcurrant purée; and from horse chestnuts a number of essential products can be prepared. Scottish school children are being asked to collect these plants.

An Irish provincial newspaper has been produced on newsprint manufactured from straw. It is dark brown in colour and was shown to the Dail by the Eire Minister for Industry and Commerce to emphasise the difficulties of the paper situation.

The following elections have been made by the board of the Institute of Physics:—Fellows: H. Dingle, D. G. Fisher, H. A. Nancarrow, F. Oldham, D. Parkinson, T. C. Richards, R. S. Silver, H. M. Smith, R. S. Vincent, W. A. Wood. In addition, 13 Associates were elected, and 18 Subscribers and 5 Students admitted.

A proposal to set up a central committee of Scottish Chambers of Commerce was approved at a joint conference of Chambers held this week at Edinburgh. Mr. J. M. Erskine, president of the Edinburgh Chamber, was nominated as the first chairman, and Colonel C. J. Hirst, president of the Glasgow Chamber, as vice-chairman.

The shortage of imported fertilisers in Eire has led to considerable developments in the home production of superphosphates from phosphate rock mined in County Clare. Work is also taking place with a view to manufacturing sulphuric acid and suitable ore is reported to have been located in County Wicklow.

An exhibition of war photographs in aid of the Red Cross Penny-a-Week Fund opens at Dorland Hall, Regent Street, S.W.1, on July 31. It will include photographs of some of the most dramatic incidents of the war, many of them hitherto unpublished. Admission is one shilling (10 a.m. to 6 p.m., including Sundays).

Foreign News

The Texas Oil Company is to erect a new oil refinery in Hamilton County, Illinois, to cost $1,000,000 with equipment.

A new charcoal plant to be built in Finland is to provide 30,000 cu. metres of charcoal annually. Special attention will be paid to by-products such as wood tar, turpentine, methyl alcohol, etc.

Industrial chemicals derived from phosphorus are the chief product of the new Monsanto plant at Trenton, Michigan, which started operations on April 28 last. The plant covers 138 acres and has its own wharf on the Detroit river.

Synthetic rubber thread has been produced from Ameripol for use as a potential war material in the U.S.A. It can be used as a substitute for natural rubber in parachute harness, in respirators, and in other equipment. None of this thread is yet available for civilian use.

Stringent regulations regarding quotas of essential materials for the film industry are expected in Hollywood. Already celluloid restriction has resulted in a less lavish use of "retakes." It is expected to become increasingly difficult to maintain elaborate film sets for there will not be the material or the labour.

Fat and oil economies in pharmacy are to be obtained in Germany by increased use of aqueous emulsions, mineral oils, mucilage, jellies, colloidal silicic acid, and aluminium hydroxide paste. Only small savings in fat consumption are expected from the use of these substitutes.

The Dutch rayon company, AKU (Allgemeene Kuntstzijde Unie), hopes to begin the production of cell wool in the autumn, provided that machinery is delivered in time. The plant for the manufacture of cellulose from straw, however, will not be completed until considerably later. A new casein wool factory has started operations at Ede.

Sweden is in no danger of a complete shortage of fuel, according to a report in the *Manchester Guardian*. Even if entirely cut off from coal and coke imports, the country has practically inexhaustible resources of peat; the peat bogs, it is stated, could cover Sweden's entire fuel requirements for at least 700 years.

The significance of platinum as a munition of war is stressed by the introduction in the U.S.A. by the War Production Board, of a strict control over purchases, stocks and sales of platinum. The sole aim of this measure is to prevent a leakage of platinum supplies, through neutral countries, to the Axis powers.

Repair of a blast furnace while in operation was accomplished at the Hamilton, Ohio, plant of the American Rolling Mill Company. With a crew working 100 feet above the ground with gas masks, welders' masks, and safety belts, leaks were effectually sealed. Had the furnace been shut down, the production of 3600 tons of steel would have been lost.

Although the eight nitrogen plants of the Montecatini combine in Italy have a sufficiently large producing capacity to cover the agricultural demand for nitrogenous fertilisers and the requirements of the explosives industry, shortage of coal has severely curtailed output. A large plant with an annual output of 20,000 tons has not been able to operate at all during the past year.

German cell-wool producers using the sulphite process for the development of methods for the utilisation of sulphite liquor have combined to form the Vereinigung Sulfitablauge G m.b.H. At present the waste liquor is mainly for the production of alcohol, though some companies have tried to treat it for cleaning powders, tanning extracts, glues, etc. It is proposed that the individual factories concentrate on only a few products of the many which can be made from waste liquors, leaving the remainder to other plants, so that operations can be on a sufficiently large scale for rational working. The company will also engage in the sale of products recovered from the liquor.

The American sulphur industry is co-operating with industrial users of sulphur to build up stocks at their plants on the advice of the War Production Board. All sulphur production and shipment records were broken in 1941. During the first three months of this year the sulphur industry increased by about 20 per cent. the rate of production established during the first quarter of 1941.

To extract the poison from castor oil residues so that they can be used as a fodder, the Richard Graebner Nahrungsmittelfabriken has developed a new process (Ger.P. 698,200). After the oil has been extracted, the residue is dried and ground to a fine powder. This is boiled repeatedly for short periods in water, which is changed each time. The powder is then filtered, washed with hot water, and dried. This process, which removes the ricin and ricinin, does not affect the fodder-providing albumin.

A new plant of Commercial Alcohols, Limited, built for producing industrial alcohol from wheat, at the request of the Government, at a cost of between $150,000 and $160,000, will be in operation about August 1, according to the president of the company. The company has been using molasses from the West Indies as its raw material for industrial alcohol, but new supplies have not been available for some time. An increasing quantity of industrial alcohol produced in Canada is being used by paint companies.

Forthcoming Events

The Institute of Petroleum, The Institute of Chemical Engineers, and the **Chemical Engineering Group** (Society of Chemical Industry), are holding a joint meeting on **July 14**, at 5.30 p.m., in the Institution of Mechanical Engineers, Storey's Gate, S.W.1, when a paper on "The Separation of Gases" will be presented by Dr. M. Ruhemann.

A meeting of the **Fuel Luncheon Club** will take place at the Connaught Rooms, Great Queen Street, W.C.2, on **July 21**, at 12.40 for 1.10 p.m., when the after-luncheon address will be given by the Rt. Hon. Lord Hyndley G.B.E., Controller-General at the Ministry of Fuel and Power.

A conference on mineral resources (excluding coal and oil) and the Atlantic Charter, arranged by the **British Association,** will take place on **July 24** and **25,** at the London School of Hygiene, Keppel Street, W.C.1. It will be opened by Sir Richard Gregory, president of the Association, and the chair at the successive sessions will be taken by Sir Thomas Holland, Sir William Larke, Dr. C. H. Desch, and Sir Stafford Cripps. Among expected speakers are Professor H. H. Read, Professor C. B. Fawcett, Professor W. R. Jones, Sir Lewis Fermor, Dr. E. F. Armstrong, Dr. W. H. Hatfield, Dr. L. Dudley Stamp, and Professor J. G. Smith.

New Control Orders

Lac for Records

The Minister of Supply has issued the Control of Lac (No. 1) Order, 1942 (S.R. & O. 1942, No. 1274), under which the use or consumption of any lac for the purpose of making sound records is made subject to licence. The Order takes effect from July 14, and applications for licences to use or to consume lac for that purpose on or after that date, whether from existing stock or not, should be addressed to the Ministry of Supply, Raw Materials Department (Lac Control), The Castle, Warwick. Lac is defined as the resinous secretion of the lac insect, whether in the form of sticklac, seedlac, buttonlac, shellac, recovered lac, or any other form.

Natural Resins

The Minister of Supply has also made the Control of Natural Resins (No. 1) Order, 1942, which came into force on July 8, and makes subject to licence the acquisition, disposal, treatment, use or consumption of damar, gum damar, manilla and gum manilla. Applications for licences, and all inquiries, should be addressed to the Miscellaneous Chemicals Control, Terminal House, 52 Grosvenor Gardens, London, S.W.1. Copies of the Order (S.R. & O. 1942, No. 1253) may be obtained (price 1d.) from H.M.S.O., or any bookseller.

Iron and Steel Scrap

The Ministry of Supply has issued the Control of Iron and Steel (No. 24) (Scrap) Order, 1942 (S.R. & O. 1942, No. 1270), which came into force on July 4. The Order provides that every person having in his possession scrap steel containing tungsten shall segregate such scrap from all other scrap and keep it so segregated. The Order does not affect the right of an owner of scrap steel containing tungsten from disposing of it in the ordinary course of business to a merchant licensed to buy such scrap. In addition, the Order further varies the Control of Iron and Steel (No. 14) (Scrap) Order, 1940, by fixing the maximum price for high-speed steel solid scrap containing 5 per cent. to 6½ per cent. tungsten and 5 per cent. to 6½ per cent. molybdenum at 9d. per lb., and for high-speed steel turnings of a similar specification at 5d. per lb. Copies of the Order (price 1d.) may be obtained from H.M.S.O., or booksellers.

British Chemical Prices

Market Reports

LITTLE change falls to be recorded in the general chemicals market this week and a difficult supply position continues for many products. However, movement under existing contracts remains substantial and a steady flow of deliveries is maintained. Bicarbonate of soda, caustic soda and nitrate of soda are receiving a steady enquiry while the demand for chlorate of soda exceeds the quantities available. Hyposulphite of soda continues firm, and strong price conditions are operating for most of the potash products in which section the tight supply position is the chief feature. Elsewhere a good demand is reported for formaldehyde and also for glycerine and borax. The undertone throughout the industrial chemical market remains firm, and steady and firm conditions are also the chief feature of the coal-tar products section. There is a ready outlet for both creosote oil and carbolic acid. Firm prices are operating for xylol and proposals have been made for placing distribution on a regional basis and the trade is awaiting further particulars.

MANCHESTER.—Fresh inquiry for chemicals on the Manchester market during the past week has been on a moderately active scale, with a corresponding weight of new business reported. Apart from a rise in quotations for the white leads and red leads, there has been little price movement of any consequence to report, though the general undertone is strong. In the meantime, contract deliveries of the general run of soda compounds and of the ammonia and magnesia products continues on steady lines, while supplies of all kinds of potash chemicals meet an active demand. Most of the acids are also being readily taken up. With the exception of pitch, pyridine and xylol, the tar products are moving well.

GLASGOW.—Business in the Scottish heavy chemical trade has been rather quieter during the past week both for home trade and export. Prices continue very firm, and where altered, are dearer.

Price Changes

Benzole.—Crude, 60's, 1s. 10d.; pure, 2s. 6d., per gal., ex works.

Creosote.—Home trade, 6½d. per gal., f.o.r., makers works; exports, 6d. to 6½d. per gal., according to grade. MANCHESTER: 6½d. to 9d.

Xylol.—Commercial, 3s. 1d. to 3s. 5½d. per gal.; pure, 3s. 2½d. to 3s. 7d. MANCHESTER: 2s. 9d. to 3s. 2d

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A new high-grade deposit of mercury-bearing ore has been discovered by the U.S. Bureau of Mines in the Yellow Pine area of Valley County, Idaho. Tests of drill samples show existence of ore averaging 11 lb. of mercury per ton, with one five-foot section averaging 22 lb. per ton. Additional drilling in the richer area is in progress and will determine the extent and importance of the discovery. The deposits are estimated to contain more than 400,000 tons of ore. Exploration of mercury-bearing ore deposits was also conducted in Nevada, California, and Oregon.

Chemical and Allied Stocks and Shares

VALUES in most sections of the Stock Exchange showed recovery early in the week, aided by some improvement in demand which followed the better war news from Egypt. Later, however, the tendency became less firm on the developments on the Russian front. Nevertheless, gains in British Funds and other front rank investments, as well as in industrial and kindred shares, have been quite well maintained at the time of writing. In many directions, shortage of stock was reported owing to the firmness with which all classes of securities continued to be held, and consequently, in some directions, it was difficult to purchase at around prices indicated by current quotations

Imperial Chemical ordinary units, which in common with other widely held industrial shares usually reflect the general market trend very closely, have rallied strongly to 32s. 3d. at the time of writing, which compares with 31s. 6d. a week ago. I.C.I. 7 per cent. preference units were 6d. better at 33s. 6d. Lever and Unilever showed recovery to 27s. 9d., while Turner and Newall were better at 68s. 9d. Murex were 92s. 6d., and British Match 34s. B. Laporte were firm, and changed hands at 66s. 3d. at one time, while at 38s. 1½d. Fison Packard were within a few pence of the price ruling a week ago. Lawes Chemical transferred around 8s. 9d. and elsewhere, W. J. Bush 5 per cent. £5 preference have been dealt in at slightly above their par value. Burt, Boulton changed hands at 14s. 9d. while elsewhere, Johnson Matthey 5 per cent. preference, which are very firmly held and do not often change hands, have shown business around 20s.

A fair amount of attention continued to be given to shares of companies with interests in plastics. Lacrinoid Products 2s. ordinary, whose interim dividend is due next month, were around 3s. 3d., while Erinoid 5s. shares were dealt in up to close on 8s. 6d. In other directions, business at slightly over 19s. has taken place in British Drug Houses, while Sangers were 16s. 1½d., Timothy Whites 22s. 4½d., and Boots Drug 34s. British Glues and Chemicals 4s. ordinary were firm at 6s. 3d., having remained under the influence of the maintained dividend. General Refractories continued to hold their recent improvement to 11s. 6d. Borax Consolidated deferred were slightly higher at 31s. 3d., but elsewhere Imperial Smelting eased to 9s. 6d. British Plaster Board were 22s. 6d. xd. There was a partial recovery to 31s. 3d. in Barry and Staines, which compares with 30s. a week ago, and despite the slightly lower interim payment, Nairn and Greenwich have remained at 52s. 6d. at the time of writing.

The units of the Distillers Co. responded to the good impression created by the report and accounts which show still further strength added to the financial position. The price has risen on balance from 74s. 3d. to 76s. xd. at the time of writing. United Molasses were 27s. compared with 26s. 9d. a week ago, while among other securities, British Oxygen also reflected the better market tendency, being steady at 65s., and British Aluminium were firm at 43s. 3d. Wall Paper Manufacturers deferred were higher at 27s. 3d. The Guest Keen dividend induced a better tendency among iron, steel and kindred issues. The ordinary shares of the last-named company were 23s. 3d. xd., while Allied Ironfounders rose strongly to 31s. Babcock and Wilcox were 42s. 6d. and Tube Investments 84s. 6d.

Courtaulds and British Celanese were higher on balance, accompanied by vague market talk of developments pending in the rayon trade. Among other textile issues, small gains were also shown by Calico Printers ordinary and preference units on hopes that earnings are running at a better level. Oil shares showed some recovery from their recent sharp decline, but best prices made in the past few days were not fully held.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

BRITISH CELANESE, LTD., Torquay. (M., 11/7/42.) June 20, £30,000 debenture stock, part of an amount already registered. *£2,786,481. December 31, 1941.

Company News

British Plaster Board, Ltd., have declared a final dividend of 15 per cent. (10 per cent.), making 25 per cent. for the year ended March 31 (15 per cent.).

Michael Nairn and Greenwich, Ltd., announce an interim dividend of 3½ per cent., compared with 4 per cent. a year ago, when the final payment amounted to 8½ per cent.

Newman and Watson, Ltd., have increased their issued capital by £20,000, in order to purchase the whole of the ordinary shares in Stockton Chemical Engineers & Riley Boilers, Ltd.

Barry and Staines Linoleum, Ltd., report a profit of £65,524 (£107,899), and have declared an ordinary dividend of 7½ per cent. (10 per cent.), the final payment being 5 per cent., as against 7 per cent. for last year.

Crosfields Oil and Cake Co., Ltd., announce a net profit, for the year ended March 31, of £10,617 (£15,031), and have declared a dividend of 15 per cent. and a bonus of 5 per cent. (same) for the year.

Titanine, Ltd., announce a profit, for the year ended March 31, of £24,953 (£22,550), and have declared a final dividend of 10 per cent., making 20 per cent. for the year (same).

The Distillers Co., Ltd., announce a profit of £1,962,168 (£2,110,936) for the year ended May 15. A final dividend of 8¾ per cent. is being paid, making 15 per cent., plus a bonus of 1¼ per cent. (same). Forward, £524,210 (£544,139).

Boots Pure Drug Company report a record sales year ended March 31, but after various deductions the net profit is slightly lower at £622,784 (£629,110). Two interim dividends of 10 per cent. have already been paid on the ordinary stock, and the final of 4 per cent., now brings the total to the previous year's rate of 24 per cent.

The Fullers Earth Union, Ltd., report a trading profit of £115,474 (£89,609), and have declared dividends of 5 per cent. on the cumulative preference shares, 11 per cent. on the non-cumulative preferred ordinary shares, and a final of 11 per cent. on the ordinary shares, making 15 per cent. for the year (same).

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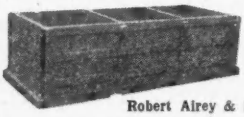

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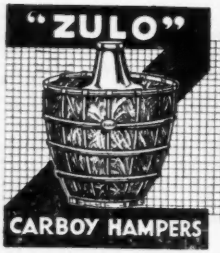

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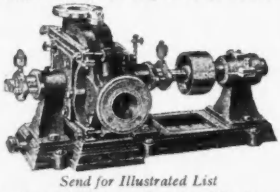

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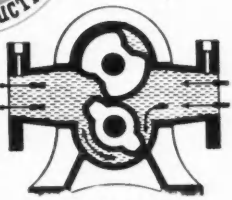

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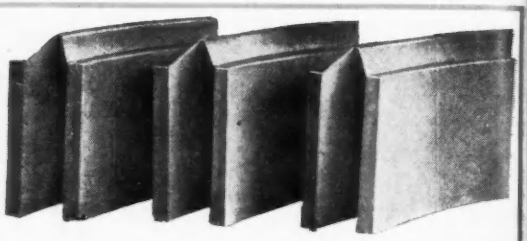

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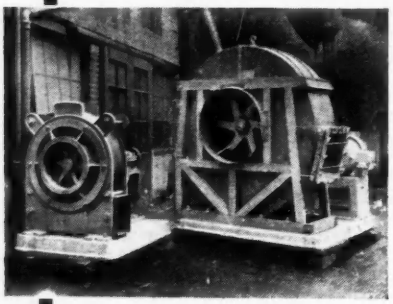

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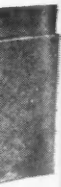

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